

**CLAIMS**

- 1 Laser welding apparatus, in which a laser beam is impinged upon a component to be welded at a laser beam impingement point, wherein plasma suppression means is arranged to impinge a jet of gas on the component at an angle between about 38° and about 52° to its surface, flowing towards the laser beam impingement point, at a distance of at least 1mm from the laser beam axis.
- 2 Laser welding apparatus as claimed in Claim 1 wherein the laser welding apparatus comprises a laser head to focus the laser beam on the laser beam impingement point, and there is provided a nozzle adjacent the laser head that, in use, provides a jet of high velocity gas over the laser head.
- 3 Laser welding apparatus as claimed in Claim 1 or Claim 2 wherein the apparatus further comprises a gas extraction means located adjacent the laser beam, diametrically opposite the plasma suppression means.
- 4 Laser welding apparatus as claimed in Claim 1 wherein the plasma suppression means is adapted to supply gas to impinge the component at an angle of between about 38° and 52°.
- 5 Laser welding apparatus as claimed in Claim 4 wherein the plasma suppression means is adapted to supply gas to impinge the component at an angle of about 45°.
- 6 Laser welding apparatus as claimed in Claim 1 wherein the plasma suppression means is adapted to supply gas at a rate of between about 10 and 18 litres per minute.
- 7 Laser welding apparatus as claimed in Claim 6 wherein the plasma suppression means is adapted to supply gas at a rate of about 14 litres per minute.

- 8    Laser welding apparatus as claimed in Claim 1 wherein the plasma suppression means comprises tubular supply means.
- 9    Laser welding apparatus as claimed in Claim 8 wherein the inner diameter of the tubular supply means is between about 6 mm and about 10 mm.
- 10    Laser welding apparatus as claimed in Claim 9 wherein the inner diameter of the tubular supply means is about 8 mm.
- 11    Laser welding apparatus as claimed in Claim 1 wherein the gas supplied by the plasma suppression means is an inert gas.
- 12    Laser welding apparatus as claimed in Claim 11 wherein the gas supplied by the plasma suppression means is argon.
- 13    Laser welding apparatus as claimed in Claim 1 wherein the plasma suppression means is adapted to supply gas to impinge the component at a distance of between about 1 mm and about 5 mm from the laser beam.
- 14    Laser welding apparatus as claimed in Claim 13 wherein the plasma suppression means is adapted to supply gas to impinge the component at a distance of about 4 mm from the laser beam.
- 15    Laser welding apparatus as claimed in Claim 1 wherein the plasma suppression means is arranged such that the gas exits the suppression means at a distance from the component surface of between about 2 mm and about 5 mm.
- 16    Laser welding apparatus as claimed in Claim 15 wherein the plasma suppression means is arranged such that the gas exits the suppression means at a distance from the component surface of about 2 mm.

- 17 Laser welding apparatus as claimed in claim 2 wherein the nozzle is a spray head nozzle.
- 18 Laser welding apparatus as claimed in Claim 2 wherein the high velocity gas exits the secondary supply means at, at least, 30 m/s.
- 19 Laser welding apparatus as claimed in Claim 2 wherein the exit nozzle of the secondary gas supply means is approximately 5 mm from the laser head.
- 20 Laser welding apparatus as claimed in Claim 2 wherein the exit nozzle comprises a row of small tubular outlets.
- 21 Laser welding apparatus as claimed in Claim 20 wherein the small tubular outlets all have an internal diameter of approximately 1 mm.
- 22 Laser welding apparatus as claimed in Claim 2 wherein the gas supplied via the secondary gas supply means is air.
- 23 A laser welding apparatus as claimed in Claim 3 wherein the gas extraction means lies between about 2 mm and about 5 mm form the surface of the component.
- 24 A laser welding apparatus as claimed in Claim 3 wherein the opening of the gas extraction means lies about 50 mm away from the axis of the laser beam.
- 25 A laser welding apparatus as claimed in Claim 3 wherein the gas extraction means is capable of extracting gas at a rate of about 80 m<sup>3</sup>/hour.
- 26 Laser welding apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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- 27 A method of laser welding a component the steps of, focusing a laser beam on substrate component, moving the component relative to the laser beam such that the laser beam impingement point moves in a welding direction, and supplying a plasma suppression gas to impinge the component adjacent the laser beam impingement point, wherein the gas flow is arranged to impinge the component at an angle of between 30° and about 60° to the component surface, and at a distance from the laser beam of at least 1 mm.
- 28 A method of laser welding a component as claimed in Claim AA wherein the plasma suppression gas is supplied to impinge at a point that lies behind the laser impingement point in the welding direction.